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FLOOD INSURANCE STUDY

ORIGINAL

CITY OF CORUNNA, MICHIGAN

SHIAWASSEE COUNTY

JANUARY 17, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 260602

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Shiawassee River Panel 01P

Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

CITY OF CORUNNA,
SHIAWASSEE COUNTY,
MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Corunna, Shiawassee County, Michigan, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Detroit District (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-E-0941, Project Order No. 11. This study was completed in February 1984.

1.3 Coordination

In August 1982, the City Manager of Corunna and representatives of the Michigan Department of Natural Resources (DNR) attended a coordination meeting to identify the flooding sources requiring detailed and approximate study methods.

The technical aspects of the study were coordinated with, reviewed, and approved by the Michigan DNR, the State Coordinating Agency.

On February 26, 1985, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Corunna, Shiawassee County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

A detailed study was used for 2.7 miles of the Shiawassee River flowing through the City of Corunna.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. Approximate methods were used to study another 1.1 miles of an unnamed tributary to the Shiawassee River.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through February 1989. The scope and methods of study were proposed to and agreed upon by FEMA, the Michigan DNR, and the City of Corunna.

2.2 Community Description

The City of Corunna is located in the south-central portion of lower Michigan in central Shiawassee County. It is located 30 miles northeast of Lansing and 22 miles west of Flint, Michigan. Incorporated in 1883 (Reference 1), the City of Corunna is completely surrounded by Caledonia Township. According to U.S. Census Bureau figures, the population increased from 2,829 in 1970 to 3,019 in 1980 (Reference 2).

The climate of the City of Corunna is characteristic of southern lower Michigan and varies from modified marine to continental. The mean annual temperature is 49 degrees Fahrenheit (F.), but extremes range from 21 degrees F. to 105 degrees F. The average annual precipitation of 31 inches is fairly well-distributed. Snowfall averages 37 inches per year. The average annual runoff is approximately 9 inches per year.

Most soils in the area are loamy soils associated with till plains and moraines. They vary from well-drained to poorly drained soils and are dark gray to dark brown on the surface (Reference 3).

The Shiawassee River flows northward until it reaches Corunna where it turns to the west and flows through the city. Leaving Corunna, it continues westward to the City of Owosso. There, it flows in a west-northwest direction through Owosso.

Ninety percent of the flood plain in Corunna is residential and the remaining 10 percent is city-owned parkland, recreational or wooded areas.

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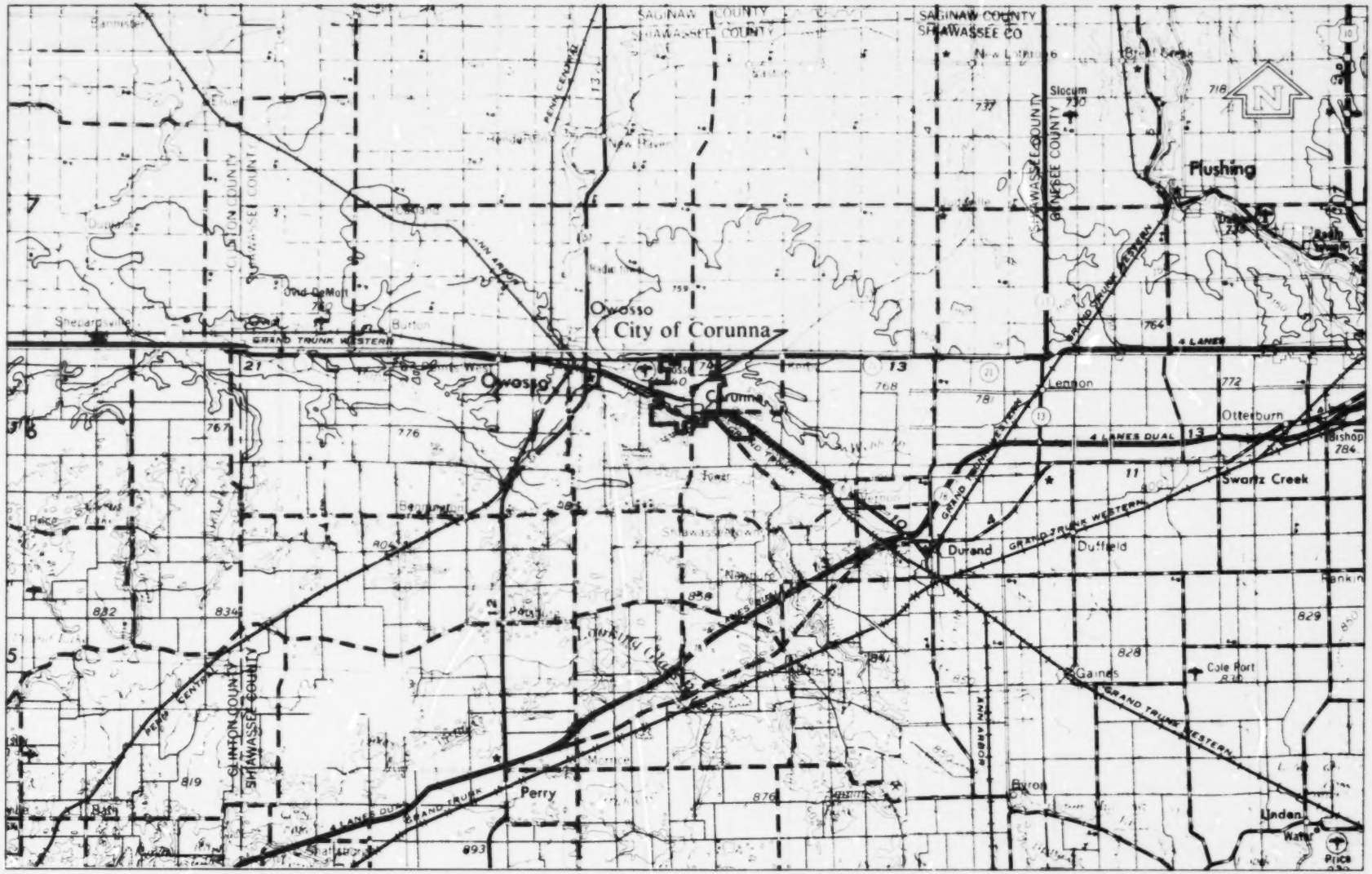

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORUNNA, MI
(SHIAWASSEE CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

FIGURE 1

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2.3 Principal Flood Problems

Major floods in the Shiawassee River basin have occurred in the winter and spring. However, floods caused by intense thunderstorms may occur at any time. Major flooding is most frequent during the months of March and April. The flood of March 1904 recorded a gage height of 8.3 feet at the U.S. Weather Bureau gage near Owosso (Reference 4). No discharge was measured since the gage was a nonrecording type. In March 1931, a recording gage was installed about 1.75 miles upstream. On April 6, 1947, a major spring storm caused flooding along the Shiawassee River. The U.S. Geological Survey (USGS) water stage recorded (No. 04144500) at Owosso recorded a height of 10.35 feet. The corresponding discharge was 6,240 cubic feet per second (cfs) with a return period of about 45 years. On April 22, 1975, another severe flood occurred on the Shiawassee River. Rains of up to 5 inches fell over the upper Shiawassee River. The river was already high as a result of a snowmelt earlier in April. The gage at Owosso recorded a stage of 9.25 feet. This resulted in a maximum discharge of 4,840 cfs with a return period of about 12 years (Reference 5). Flood losses in excess of $3 million in the Shiawassee River basin were attributed to this storm.

2.4 Flood Protection Measures

A dam on the Shiawassee River at Corunna is located about 1,000 feet upstream of the State Road bridge. The dam is 190 feet long and consists of a concrete and rockfill structure with wooden floodgates. The upstream water level is permanently set at about 10 feet above the channel bottom. The dam does not provide any flood protection.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Hydrologic analyses for the Shiawassee River studied in detail in the City of Corunna were based on annual peak flows recorded during the period of 1931-1982 at the USGS gaging station (No. 04144500) at Owosso (Reference 5). The gage is situated 1.5 miles north of Owosso and about 3 miles downstream of the study area.

The log-Pearson Type III method was employed to analyze the peak flows. A generalized skew coefficient of -0.09 was used (Reference 6). Applying the log-Pearson method, the 10-, 50-, 100-, 500-year flows were determined. The peak flows required at the upstream and downstream limits of the study area were extrapolated from the gage using an exponent of 0.889 computed from data published in USGS Water Supply Paper 1677 (Reference 4).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SHIAWASSEE RIVER at downstream corporate limits	514	4,440	6,270	7,050	8,870

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals.

Flood plain cross sections for the Shiawassee River were field surveyed in November and December 1982.

Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map.

Roughness coefficients (Manning's "n") were chosen by engineering judgment based on field observations. Values for the Shiawassee River in the City of Corunna were 0.030 for the natural channel and 0.050 for the overbanks.

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Shiawassee River flood elevations determined for the Flood Insurance Study for the Township of Caledonia (Reference 7) were used as starting water-surface elevations. The water-surface profiles for the Shiawassee River were developed through the use of the COE HEC-2 computer program (Reference 8).

For streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations or from information extracted from adjacent detailed studies and topographic maps.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929. Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections the boundaries were interpolated using topographic maps enlarged to a scale of 1:24000 with a contour interval of 10 feet (Reference 9).

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown. Approximate flood boundaries were delineated on the above-referenced topographic maps.

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

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4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. In Michigan though, under Michigan Act 245, Public Acts of 1929, as amended by Act 167, Public Acts of 1968 (Reference 10), encroachment in the flood plain is limited to that which will cause only an insignificant increase in flood heights. Thus, at the recommendation of the Bureau of the Water Management, a floodway having no more than a 0.1-foot surcharge has been delineated for this study.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain using the HEC-2 step-backwater computer model (Reference 8). The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed and are presented in Table 2, Floodway Data.

As shown on the Flood Boundary and Floodway Map, the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway for the Shiawassee River lie outside the corporate limits.

The area between the floodway and the 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SHIAWASSEE RIVER								
A	257,701	425	2776	2.5	734.6	734.6	734.6	0.0
B	260,501	545	2819	2.5	735.3	735.3	735.3	0.0
C	261,501	292	1754	4.0	735.6	735.6	735.6	0.0
D	262,401	574	3455	2.0	736.3	736.3	736.3	0.0
E	263,601	222	1551	4.5	736.6	736.6	736.6	0.0
F	263,901	167	1433	4.9	736.8	736.8	736.9	0.1
G	265,501	370	2718	2.6	740.4	740.4	740.4	0.0
H	265,801	764	4548	1.6	740.6	740.6	740.6	0.0
I	266,601	1301	5424	1.3	740.7	740.7	740.7	0.0
J	268,501	1260	5576	1.3	740.9	740.9	740.9	0.0
K	271,101	762[2]	4064	1.7	741.3	741.3	741.3	0.0

[1]FEET ABOVE MOUTH
[2]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORUNNA, MI
(SHIAWASSEE CO.)

FLOODWAY DATA

SHIAWASSEE RIVER

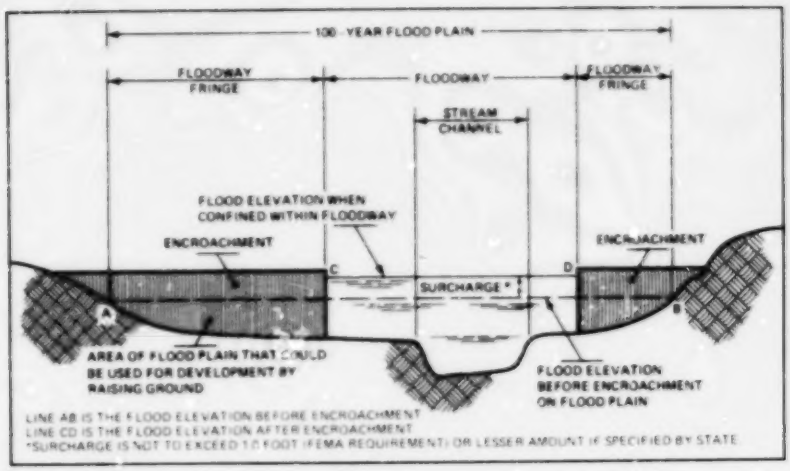
100 - YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Corunna.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the weighted average difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the riverine flooding sources of the City of Corunna are shown on the Flood Profiles and are summarized in Table 3, Flood Insurance Zone Data.

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5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a riverine reach is the weighted average difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For example, if the difference between elevations is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A3, A5:	Special Flood Hazard Areas inundated by the 100-year flood, with base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community are shown in Table 3, Flood Insurance Zone Data.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
SHIAWASSEE RIVER							
REACH 1	0001	−2.5	−0.7	1.7	025	A5	VARIES—SEE MAP
REACH 2	0001	−1.5	−0.4	1.0	015	A3	VARIES—SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORUNNA, MI
(SHIAWASSEE CO.)

FLOOD INSURANCE ZONE DATA

SHIAWASSEE RIVER

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5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Corunna is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines for riverine flooding sources show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

This study matches exactly with the Flood Insurance Study completed for the Township of Caledonia (Reference 7).

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for City of Corunna (Reference 11).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

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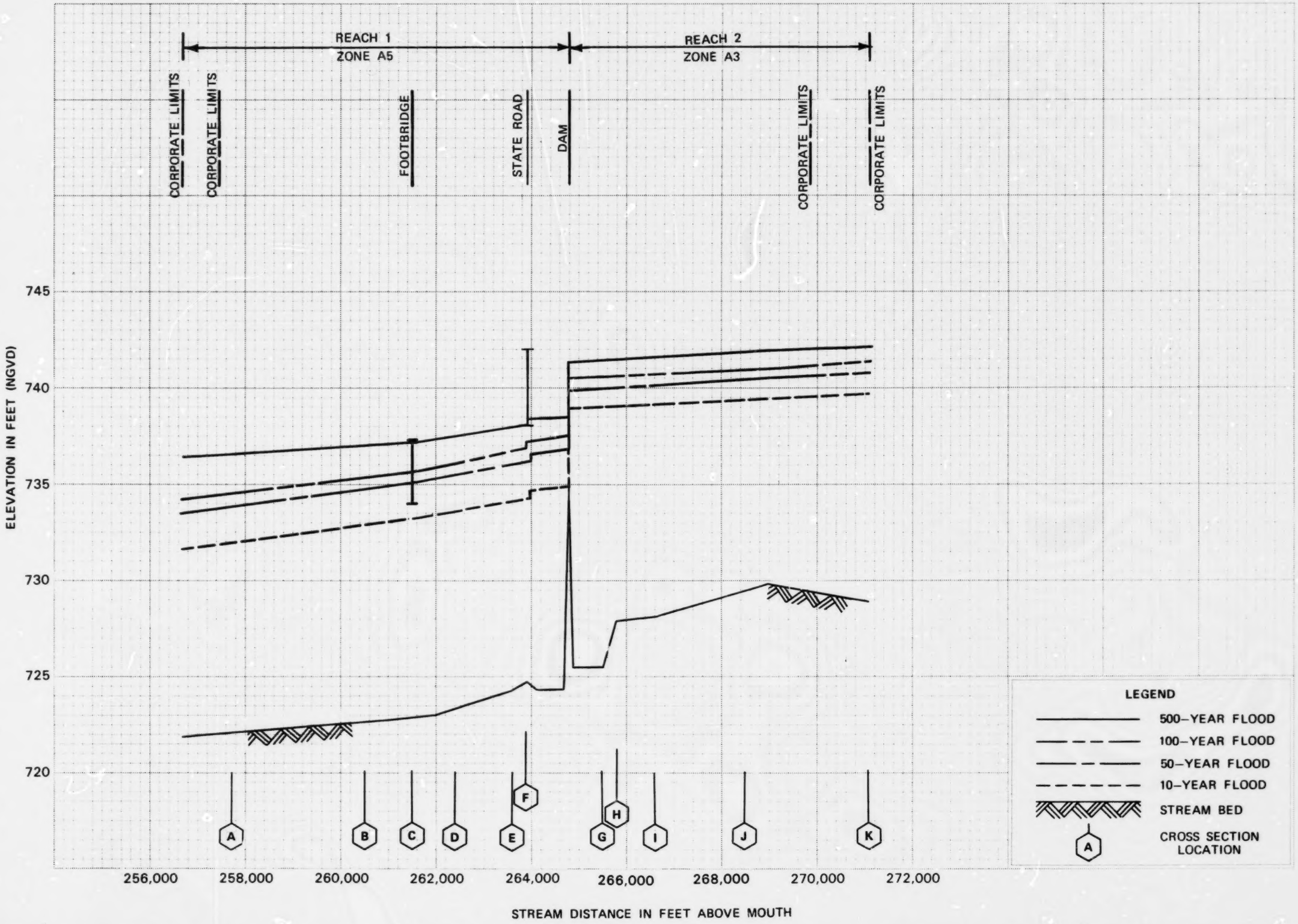

FLOOD PROFILES

SHIAWASSEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CORUNNA, MI
(SHIAWASSEE CO.)

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